### Microbial Biotechnology (MR)

#### Master of Microbial Biotechnology Degree Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
<th>Counts towards</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Microbiology / Science Core Courses</strong></td>
<td></td>
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<td></td>
<td>Select two of the following courses:</td>
<td>6</td>
<td>Microbiology / Science Core courses</td>
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<tr>
<td>MB 555</td>
<td>Microbial Biotechnology</td>
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<tr>
<td>MB 714</td>
<td>Microbial Metabolic Regulation (Recommended)</td>
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<tr>
<td>MB 751</td>
<td>Immunology</td>
<td></td>
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<tr>
<td>MB 758</td>
<td>Microbial Genetics &amp; Genomics</td>
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<tr>
<td>MB 590</td>
<td>Topical Problems (Environmental Microbiology and Biotechnology)</td>
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<tr>
<td>PB 580</td>
<td>Introduction to Plant Biotechnology</td>
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<tr>
<td></td>
<td><strong>Science Electives</strong></td>
<td>3</td>
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<td>Select one course below</td>
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<tr>
<td>BAE 525</td>
<td>Industrial Microbiology and Bioprocessing</td>
<td>3</td>
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<tr>
<td>BAE 528</td>
<td>Biomass to Renewable Energy Processes</td>
<td>3</td>
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<td><strong>Biochemistry (BCH)</strong></td>
<td>3</td>
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<tr>
<td>BCH 553</td>
<td>Biochemistry of Gene Expression</td>
<td>3</td>
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<tr>
<td>BCH 555</td>
<td>Proteins and Molecular Mechanisms</td>
<td>3</td>
<td></td>
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<tr>
<td>BCH 571</td>
<td>Regulation of Metabolism</td>
<td>3</td>
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<td>BCH 701</td>
<td>Macromolecular Structure</td>
<td>3</td>
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<td>BCH 703</td>
<td>Macromolecular Synthesis and Regulation</td>
<td>3</td>
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<td>BCH 705</td>
<td>Molecular Biology Of the Cell</td>
<td>3</td>
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<tr>
<td>BCH 751</td>
<td>Biophysical Chemistry</td>
<td>3</td>
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*Incoming students may be able to opt out of this requirement if they can provide sufficient evidence that indicates basic experience and understanding of technologies including recombinant DNA procedures, gene expression, isolation and identification of nucleic acids and proteins. Evidence may include a letter from current or former supervisors and/or professors attesting that the applicant possesses at least basic understanding and experience. Applicants with doctoral training in a related area may opt out of BIT 510 OR BEC 540, with MMB approval.*
CBS 565  Fundamentals of Biomedical Sciences  3

Food Science (FS)
FS 502  Chemistry of Food and Bioprocessed Materials  4
FS 553  Food Laws and Regulations  3

Genetics (GN)
GN 521  Molecular Genetics  3
GN 730  Fungal Genetics and Physiology  3
GN 735  Functional Genomics  3

Microbiology (MB)
MB 501  Biology of Plant Pathogens  3
MB 505  Food Microbiology  3
MB 532  Soil Microbiology  4
MB 575  Introduction to Mycology  4
MB 718  Introductory Virology  3
MB 725  Fermentation Microbiology  3
MB 730  Fungal Genetics and Physiology  3
MB 751  Immunology  3
MB 758  Microbial Genetics & Genomics  3
MB 774  Phycology  3

Plant Biology (PB)
PB 580  Introduction to Plant Biotechnology  3

Plant Pathology (PP)
PP 530  Agriculture, Ethics and the Environment  3

Statistics (ST)
ST 511  Statistical Methods For Researchers I  3
ST 512  Statistical Methods For Researchers II  3
ST 513  Statistics for Management and Social Sciences I  3
ST 520  Statistical Principles of Clinical Trials  3

Toxicology (TOX)
TOX 515  Environmental Toxicology  4
TOX 710  Molecular and Biochemical Toxicology  3

Biotechnology (BIT) and Biomanufacturing (BEC) Electives

Select two courses below

Biotechnology (BIT)
BIT 501  Ethical Issues in Biotechnology  1
BIT 562  Gene Expression Analysis: Microarrays  2
BIT 563  Fermentation of Recombinant Microorganisms  2
BIT 564  Protein Purification  2
BIT 565  Real-time PCR Techniques  2
BIT 566  Animal Cell Culture Techniques  2
BIT 567  PCR and DNA Fingerprinting  2
BIT 568  Genome Mapping  2
BIT 569  RNA Purification and Analysis  2
BIT 581  Plant Transformation  2
BIT 595  Special Topics  1-6
BIT 815  Advanced Special Topics  1-6

Biomanufacturing (BEC)
MB 520  Fundamentals of Microbial Cell Biotransformations  2
BEC 532  Foundations of Downstream Processing and Formulation  2
BEC 536  Introduction to Downstream Process Development  2
BEC 575  Global Regulatory Affairs for Medical Products  3
BEC 580  cGMP Fermentation Operations  2
Accelerated Bachelor’s/Master’s Degree Requirements

The Accelerated Bachelors/Master’s (ABM) degree program allows exceptional undergraduate students at NC State an opportunity to complete the requirements for both the Bachelor’s and Master’s degrees at an accelerated pace. These undergraduate students may double count up to 12 credits and obtain a non-thesis Master’s degree in the same field within 12 months of completing the Bachelor’s degree, or obtain a thesis-based Master’s degree in the same field within 18 months of completing the Bachelor’s degree.

This degree program also provides an opportunity for the Directors of Graduate Programs (DGPs) at NC State to recruit rising juniors in their major to their graduate programs. However, permission to pursue an ABM degree program does not guarantee admission to the Graduate School. Admission is contingent on meeting eligibility requirements at the time of entering the graduate program.

Faculty

Full Professors

Jose Bruno-Barcena
Amy Michele Grunden
Christine Hawkes
Michael Hyman
Scott M. Laster
Eric S. Miller

Assistant Professors

Manuel Kleiner

Adjunct Faculty

Jason Caplan